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CONNECTICUT RIVER BASIN
LEBANON, NEW HAMPSHIRE

GLEN ROAD DAM NH 00159

STATE NO 134.12

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

FEBRUARY 1979

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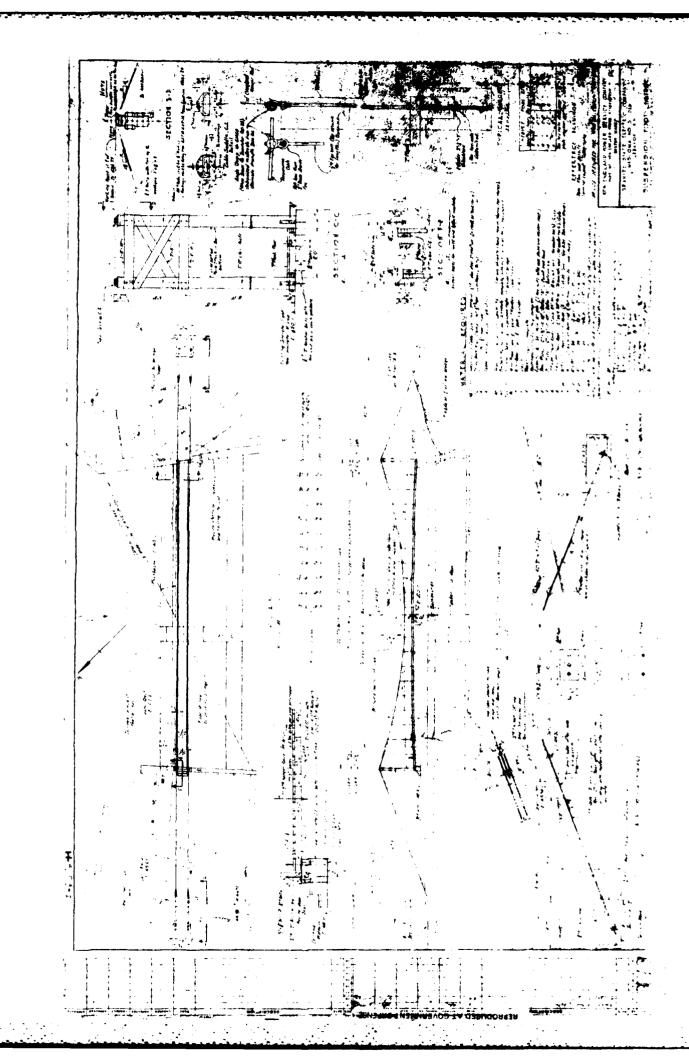
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam has a hydraulic height of 22 ft. with a length of 175 ft. The dam is in poor condition and there are verious major congerns which must be corrected. It is small in size with a significant hazard potential classification.

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DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, COPPS OF ENGINEERS

424 TRAPELO ROAD

WALTHAM, MASSACHUSETTS 02154

REPLY TO ATTENTION OF:

NEDED

Honorable Rugh J. Gailen Governor of the State of New Hampshire State Mouse Concord, New Hampshire 03301 GRA&I

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Dear Governor Gallen:

I am forwarding to you a copy of the Glen Road Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the baginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, City of Lebanon, 51 North Park, Engineering Department, Lebanon, New Hampshire 03766.

Copies of this report will be made available to the public, upon eaquest, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

Incl As stated MAX B. SCHEIDER

Colonel, Corps of Engineers

Division Engineer

NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT

Identification No.: NH00159

Name of Dam: Glen Road Dam City: City of Lebanon

County and State: Grafton County, New Hampshire

River: Mascoma River
Date of Inspection: November 9, 1978

BRIEF ASSESSMENT

Glen Road Dam, also known as Mascoma Dam No. 3, has a hydraulic height of 22 feet, is 175 feet in length, and 5 feet wide at the crest. It is a run-of-the-river timbercrib dam, with crest faced on upstream and downstream sides with plank decking. The northwest abutment consists of two gated 6.5" diameter conduits with operable lift mechanisms. A 6-feet low-flow sluiceway, centrally located in the spillway, has had the gate lift mechanism removed. The southeast abutment gatehouse is inoperable. The dam spans a reach of the Mascoma River, and is located in west-central New Hampshire. Maximum storage capacity is about 60 acre-feet. The pond is 0.2 miles in length with a surface area of about 3.5 acres.

The dam is in poor condition. Major concerns are: the deteriorated planking on the upstream face and crest, and absence of much of the decking downstream; absence of and the deteriorated condition of structural timbers; eroded or displaced rockfill on downstream side; large leakage and/or seepage along downstream toe, around sluiceway, and between spillway and gate structure; and silt accumulation upstream of and on the dam.

Based on small size and significant hazard potential classifications in accordance with Corps guidelines, the test flood is ½ Probable Maximum Flood (PMF). A test flood outflow of 15,825 cfs (82 csm) would overtop the dam by 2.8 feet (9.7 feet over spillway crest). The spillway, if it remained in place, would pass 8,470 cfs or about 54 percent of the test flood. A major breach at top of dam would probably result in the loss of no lives but could conceivably cause significant property damage.

The owner, the City of Lebanon, should implement the results of the recommendations and remedial measures given in Sections 7.2 and 7.3 respectively, within one year after receipt of this Phase I inspection report.

Warren A. Guinan Project Manager N.H. P.E. 2339 This Phase I Inspection Report on Glen Road Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

DOSEPH W. FENEGAN, JR., MEMBER
Water Control Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER

Design Branch

Engineering Division

JOSEPH A. MCELROY, CHAIRMAN Chief, NED Materials Testing Lab.

Foundations & Materials Branch

suppl Q. Mr Elroy

Engineering Division

APPROVAL RECOMMENDED:

EUE B. FRYAR

Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

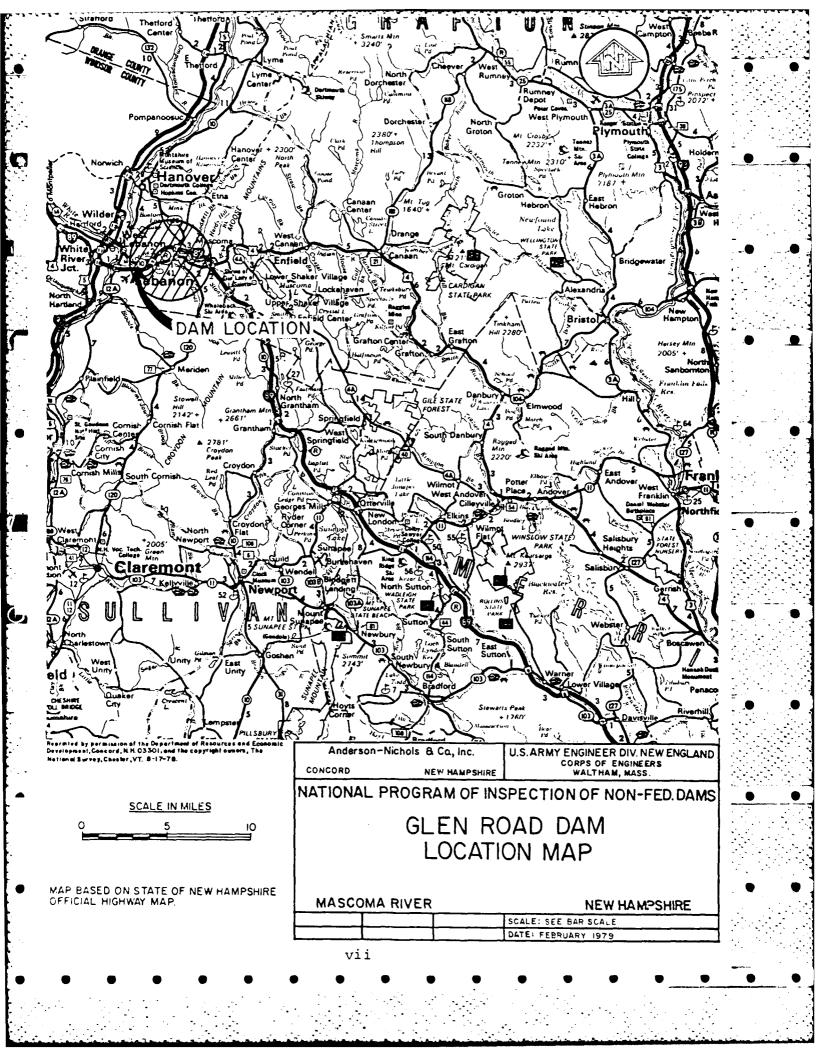
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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Figure 1 - Overview of Glen Road Dam.



NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT GLEN ROAD DAM

SECTION 1 PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Anderson-Nichols & Company, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Anderson-Nichols under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0009 has been assigned by the Corps of Engineers for this work.

b. Purpose

- (1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) To encourage and prepare the States to initiate quickly effective dam safety programs for non-Federal dams.
- (3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Glen Road Dam (Mascoma Dam No. 3) is located in the City of Lebanon, New Hampshire. The dam is a run-of-the-river dam spanning the Mascoma River, a major tributary of the Connecticut River. After discharging over the dam, the Mascoma River flows south then westerly for a distance of 1.5 miles before becoming confluent with the Connecticut River. The dam is shown on U.S.G.S. Quadrangle, Hanover, Vermont - New Hampshire with coordinates approximately at N 43° 38' 06", W 72° 18' 18", Grafton County, New Hampshire. (See Location Map page vii.)

- Description of Dam and Appurtenances. Glen Road Dam is a rock-filled timber-crib run-of-the-river dam, with a hydraulic height of 22 feet, and 175 feet long. The spillway is 123 feet long placed between two concrete abutments. As originally constructed, the dam has a plank facing on the upstream face, crest, and downstream face. The northwest abutment structure served as the foundation to a power plant. Two headgates control two 6'5" diameter conduits that discharge into the former tailrace. The gates are manually operated with control mechanisms located directly above each gate. The southeast abutment structure served as the inlet works to a penstock to supply a power plant farther downstream. The gates are manually operated with control mechanisms located directly above each gate, but are now inoperable. Access to the gatehouse on the southeast side of the dam from Glen Road is by a suspension foot bridge above the spillway of the dam. the center of the dam there is a 6-foot sluiceway with discharge controlled by a 6.5'W x 8.5'H timber gate. The lifting mechanism for this gate has been removed.
- c. Size Classification. Small (hydraulic height 22 feet; storage 60 acre-feet) based on storage (\geq 50 to < 1000 acre-feet) as given in Recommended Guidelines for Safety Inspection of Dams.
- d. <u>Hazard Classification</u>. Significant Hazard. A major breach in the dam would probably result in no loss of life but could cause appreciable property damage. (See Section 5.1 f.)
- e. Ownership. The earliest recorded ownership was the Grafton County Electric Light and Power Company, in 1930. Ownership was transferred to the Granite State Electric Company between 1935 and 1937 and then transferred again to the City of Lebanon sometime after 1963.
- f. Operator. The current owner and operator of the dam is the City of Lebanon, New Hampshire, Engineering Department, 51 North Park. Phone: (603) 448-4220.
- g. Purpose of Dam. The dam was originally constructed to provide storage to produce electricity from a power plant located at the dam. This use was discontinued prior to 1930. From that time on the dam provided water for plant No. 4 which was located about one mile downstream. A penstock led directly to the No. 4 plant. The dam and penstock is now abandoned.
- h. Design and Construction History. The original dam was constructed prior to 1930. It was reconstructed in 1940 by the New England Power Service Company for the Granite State Electric Company. A full set of plans of the new dam

were found on file at the New Hampshire Water Resources Baord (NHWRB). (See Appendix C.)

i. Normal Operational Procedures. No operational procedures or maintenance are being done at this time.

1.3 Pertinent Data

a. Drainage Area. The drainage area consists of 193 square miles (123,520 acres) of predominantly wooded terrain.

b. Discharge at Damsite

- (1) Outlet Works (conduits) Two 6'5" diameter conduits @ invert elevation 402' MSL. Combined capacity at top of dam 1540 cfs @ 419' MSL. Siuice gate not operable. Penstock at gatehouse on southeast abutment not operable.
- (2) The maximum discharge at damsite a U.S.G.S. gaging station with a drainage area of 153 square miles is located on the Mascoma River near Mascoma, New Hampshire. A maximum discharge of 5840 cfs was recorded at this gaging station during the March 1936 flood. Using this figure, the maximum discharge at damsite can be interpolated to be about 6,950 cfs.
 - (3) Ungated spillway capacity @ top of dam 8,470 cfs @ 419.0' MSL
 - (4) Ungated spillway capacity @ test flood elevation 14,120 cfs @ 421.8' MSL
 - (5) Gated spillway capacity @ top of dam elevation not applicable
 - (6) Gated spillway capacity @ test flood elevation not applicable
 - (7) Total spillway capacity @ test flood elevation 14,120 cfs @ 421.8' MSL
 - (8) Total project discharge @ test flood elevation -15,825 cfs @ 421.8' MSL
- c. Elevation (feet above MSL based on elevation from dam plans on southeast abutment at elevation 420.11' MSL.)
- (2) Maximum tailwater with an estimated maximum discharge of 6,950 cfs during the March 1936 flood, maximum tailwater could be estimated to have been 403' MSL.

- (3) Upstream invert low-level outlets 402.0
- (4) Recreation pool not applicable
- (5) Full flood control pool not applicable
- (6) Spillway crest 412.1
- (7) Design surcharge (Original Design) unknown
- (8) Top of dam 419.0
- (9) Test flood pool 421.8
- d. Reservoir (miles)
 - (1) Length of maximum pool 0.4
 - (2) Length of pool at spillway crest 0.2
 - (3) Length of flood control pool not applicable
- e. Storage (acre-feet)
 - (1) Recreation pool not applicable
 - (2) Flood control pool not applicable
 - (3) Spillway crest pool 30 (approximate)
 - (4) Top of dam 60 (approximate)
 - (5) Test flood pool 76 (approximate)
- f. Reservoir Surface (acres)
 - (1) Recreation pool not applicable
 - (2) Flood control pool not applicable
 - (3) Spillway crest 3.5 (approximate)
 - (4) Test flood pool 6.5 (approximate)
 - (5) Top of dam 5.6 (approximate)

g. Dam

- (1) Type rock-filled timber crib between two vertical concrete walls; available records indicate that dam is founded partly on "ledge" and partly on "gravel".
 - (2) Length 175'
 - (3) Height 23' (structural height)
 - (4) Topwidth 5'
 - (5) Zoning not applicable
 - (6) Impervious core not applicable
 - (7) Cutoff unknown
 - (8) Grout curtain unknown
 - h. <u>Diversion and Regulating Tunnel</u>. Not applicable. (See j. below)

i. Spillway

- (1) Type timber-crib run-of-the-river
- (2) Length of weir 123'
- (3) Crest elevation 412.1' MSL
- (4) Gates One 6.5' x 8.5' sluice gate at the center of the spillway which controls discharge into a 6-foot sluiceway. The lifting mechanism has been removed and the gate is in the closed position. The only discharge through the sluice is leakage.
- (5) U/S Channel Mascoma River The channel bottom upstream is covered with silt. The south bank of the channel is heavily covered with trees. The north bank of the channel immediately upstream is lightly covered with brush.
- (6) D/S Channel The channel downstream of the dam is generally wide and unobstructed. The channel bottom is in bedrock and contains many large boulders. A railroad bridge, with no center pier and with abutments well back onto the sides of the valley, is located a few hundred feet downstream of the dam. The Mascoma River discharges into the Connecticut River slightly over 1.5 miles downstream of Glen Road Dam. Located along this reach is a large shopping mall.

- (7) General 4-foot wide suspension access bridge over spillway.
- j. Regulating Outlets. No gates are in operation at the present time. The two gates at the southeast abutment gatehouse are closed and the lifting devices are inoperable. These gates were the inlets to a surge tank for a penstock to power station No. 4. At the northwest abutment one of the two gates which controls two 6-foot, 5-inch diameter conduits is partially open but both are jammed with timber and other debris. The lifting mechanisms appear to be operable.

SECTION 2 ENGINEERING DATA

2.1 Design

No engineering design data were disclosed for Glen Road Dam.

2.2 Construction

The reconstruction plans of Glen Road Dam in 1940 by the New England Power Service Company for the Granite State Electric Company are the only construction data that were available.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

- a. Availability. A search of the files of the NHWRB and contact with the owner revealed only a limited amount of recorded information. Reconstruction plans were found in the files of the NHWRB.
- b. Adequacy. The final assessments and recommendations of this investigation are based on the visual inspection and the hydrologic and hydraulic calculations in conjunction with the available 1940 reconstruction plans.
- c. <u>Validity</u>. The dimensions on the existing plans were consistent with what was seen at the time of the inspection.

SECTION 3. VISUAL INSPECTION

3.1 Findings

- a. General. Glen Road Dam is a low, run-of-the-river dam which impounds a reservoir of small size. At the time of the inspection, the water level in the reservoir was about 2 feet below the crest of the dam, and the entire flow of the river was leaking through the dam and gates. The down-stream face of the dam was dry and accessible for inspection. Both abutments were also accessible for inspection.
- Dam. Glen Road Dam is a rock-filled timber-crib structure, about 23 feet high, 5 feet wide at the crest, and 175 feet long. (See Appendix C - Figure 2.) As originally constructed, the dam had a plank facing on the upstream face, crest, and downstream face. The plank facing which is visible above water level on the upstream face is badly deteriorated. (See Appendix C - Figures 3 and 4.) At one location there is a small whirlpool, which is presumably evidence of a large concentrated leak through the upstream plank facing. planks on the crest of the dam are also badly deteriorated. Most of the plank facing on the downstream face is missing, and a few remnants are very badly deteriorated. Several pieces of the timber-crib structure are also missing, and the remnants that are still in place and visible are badly deteriorated. Significant quantities of the rockfill have also been washed out from the downstream side of the crib. (See Appendix C - Figures 5 and 6.) The individual pieces of rockfill are about 1 to 2 feet in size.

Substantial quantities of leakage and/or seepage are discharging from the downstream toe of the dam along its entire length. At some locations the noise of water cascading down through the rockfill can be heard. The greatest concentration of leakage is adjacent to the low-level, gated sluice near the center of the dam. (See Appendix C - Figures 2 and 5.) It was not possible to determine from the visual inspection whether the leakage at the sluice was taking place primarily through the gate itself or through the zone immediately around the sluice. There are also concentrations of leakage, but of much smaller magnitude, adjacent to each of the gate structures at the ends of the dam.

The northwest end of the dam appears to be founded on bedrock which is visible at the downstream toe of the dam. At the southeast end of the dam, sand, gravel, and boulders are visible at the downstream toe. These observations are

consistent with the comment in a questionnaire dated June 12, 1935 (prior to renovation of the dam in 1940) to the effect that the dam was founded on "ledge at north end, probably gravel at the south end."

A number of logs have washed over the dam and are lodged on the downstream face near the north abutment. (See Appendix C - Figure 6.)

A large amount of debris is lodged against the intake structure on the northwest end of the dam substantially restricting the flow. (See Appendix C - Figure 7.) Silt has accumulated in the reservoir to an elevation several feet below the crest of the dam.

A concrete gate structure is located at either end of the dam. (See Appendix C - Figures 8 and 9.) No evidence of seepage through the abutments was noted around the ends of the concrete gate structures, although as mentioned above, evidence of concentrated leakage was visible at the contacts between the dam and the two gate structures.

c. Appurtenant Structures

- Northwest Abutment Gate Structure. existing northwest abutment gate structure served as the foundation for a power plant. Visual inspection of the existing concrete structure indicates that the concrete is deteriorated. (See Appendix C - Figure 10.) Numerous areas have spalled and the downstream face of the structure shows efflorescence. The concrete training walls have numerous cracks and general areas of spalling. The visible portion of the wooden gates is deteriorated and the downstream ends of the steel draft tubes are badly corroded. (See Appendix C - Figure 11.) The remaining mechanical gate operating mechanisms appear in fair condition with minimal deteriora-(See Appendix C - Figure 12.) Although the two gates are in the open position, wood and other debris has collected in front of the gate openings and substantially obstructs flow.
- (2) Southeast Abutment Gate Structure. The existing southeast abutment gate structure served as the inlet works to a penstock supplying a power plant farther downstream. (See Appendix C Figure 9.) Visual inspection of the structure revealed the concrete below the first floor level is spalled and cracked in numerous areas. The upstream face of the concrete and gates has been silted to within two feet of the dam crest. The wood-frame building has also deteriorated and has been vandalized.

The interior of the structure was not inspected because of the presence of septic sewage odors. The hand operated gate mechanism which is still intact is in fair condition. The exposed portion of the concrete penstock downstream of the gate structure was observed to be in fair condition with limited surface spalling.

- (3) Service Bridge. The cable-suspended walk bridge over the dam was observed to be fair condition. (See Appendix C Figure 13.) The main suspension cable was observed to be corroded on the surface. The deck of the walkway is constructed of treated wood plank. Some evidence of deterioration was observed in the wood decking. It was also noted that the south end of the suspension bridge deck was loose from the bearing pad. At the time of inspection, entrance to the bridge from the northwest abutment was boarded up, preventing free access to the bridge.
- d. Reservoir Area. The drainage area above the dam is rolling terrain. The lower elevations are generally clear and the higher elevations are generally forested. Upstream of Glen Road Dam are several dams; the nearest one is about one-half mile upstream. The reservoir is silted up to about 2 feet below the crest of the dam on the southeast side; siltation is much lower on the northwest side. (See Appendix C Figure 14.)
- e. <u>Downstream Channel</u>. The channel downstream of the dam is generally broad and unobstructed. (See Appendix C Figure 15.) The channel bottom consists primarily of bedrock and boulders, with some sand and gravel. A railroad bridge, with no center pier and with abutments well back onto the sides of the valley, is located a few hundred feet downstream of the dam. The Mascoma River discharges into the Connecticut River slightly over 1.5 miles downstream of Glen Road Dam.

3.2 Evaluation

Based on the visual inspection, Glen Road Dam is considered to be in poor condition. The timber-crib and the rockfill in the crib are so badly deteriorated and eroded that the dam could wash out under floodflow conditions. If the dam does wash out, the quantity of water that will be released is relatively small, because of the silt in the reservoir. A large volume of silt might be carried downstream over a period of months or years. The silt itself may contain pollutants, if any were dumped in the river in years past. Pollutants could cause environmental damage downstream if the dam were breached, either accidentally or deliberately.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Procedures

No operational procedures have been followed for the Glen Road Dam as it has essentially been abandoned.

4.2 Maintenance of Dam

The City of Lebanon is responsible for the maintenance of Glen Road Dam. At the present time nothing is being done to maintain the dam.

4.3 Maintenance of Operating Facilities

At the present time no maintenance is being performed on the operating facilities.

4.4 Description of Any Warning System in Effect

No warning system was disclosed for the Glen Road Dam.

4.5 Evaluation

Because of the poor condition of the dam, the present assessment reflects major problems that are not amenable to simple operating and maintenance procedures.

SECTION 5. HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features

- a. Design Data. No original hydrologic and hydraulic design data were found for the Glen Road Dam.
- b. Experience Data. No information regarding past overtopping failure was found.
- c. <u>Visual Observations</u>. At the time of inspection, visible evidence of damage to the dam was noted. The damage appears to have occurred over a long period of time by the normal flow conditions throughout the years and probably not by excessive discharges.
- d. Test Flood Analysis. Glen Road Dam is classified as being small in size having a maximum storage of 60 acrefeet and a hydraulic height of 22 feet. Using the Recommended Guidelines for Safety Inspection of Dams, the test flood was determined to be ½ the Probable Maximum Flood (PMF). Using ½PMF, the test flood discharge for Glen Road Dam, having a drainage area of 193 square miles, was determined to be 15,826 cfs. The overtopping analysis indicates that the dam during the test flood would be overtopped by 2.7 feet (9.7 feet over the spillway crest). The spillway capacity at top of dam is 8,470 cfs which is 54 percent of the test flood discharge.
- e. Dam Failure Analysis. To determine the hazard classification for the Glen Road Dam the impact of failure of the dam at normal pool was assessed using Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to the shopping center, a distance of approximately 1.0 mile. A breach at Glen Road Dam under normal flow conditions would result in an increase in stage of about 1 foot at this shopping center above the 2-foot antecedent stage. An increase in water depth and a release of channel clogging debris consisting of timbers and rock from the dam, would probably not cause loss of life, but could result in significant property damage to the shopping center, Boston and Maine Railroad bridge and Route 12A bridge. As a result of this analysis, Glen Road Dam was classified Significant Hazard.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. <u>Visual Observations</u>. The following visual observations indicate Glen Road Dam is not in stable condition:
- (1) Deterioration of planking on upstream face and crest of dam.
- (2) Presence of a small whirlpool above the upstream face, which indicates a large concentrated leak through the plank facing.
- (3) Absence of plank facing over most of the downstream face and severe deterioration of the plank facing that remains.
- (4) Absence of several timbers from the timber-crib structure and severe deterioration of the timbers that are exposed on the downstream face.
 - (5) Erosion of rockfill on downstream side of dam.
- (6) Large leakage and/or seepage discharge along the downstream toe of the dam, with a large concentration of flow adjacent to the low-level sluice outlet near the center of the dam, and minor concentrations of flow at the ends of the dam adjacent to the gate structures.

In addition, a large amount of debris has accumulated behind the trash racks in the gate structure at the northwest abutment, and both of the gates at the northwest abutment are plugged with logs and other debris.

- b. Design and Construction Data. Drawings are available showing the layout of the dam and the cross-section of the rock-filled timber-crib. The following statement was found in available records: "Where the new cribbing is to be laid on bedrock the holes will be drilled in the ledge to provide a means of pinning the cribbing." No other design and construction data are available.
- c. Operating Records. Available records indicate that the reservoir was drained and the area immediately upstream of the dam was dredged in 1960. No other operating records pertinent to the structural stability of the dam were disclosed.

- d. Post-Construction Changes. No records were disclosed of changes to the dam after its reconstruction in 1940.
- e. Seismic Stability. This dam is in Seismic Zone 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7 ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. Glen Road Dam is in poor condition. The principal concerns with respect to the integrity of the dam are:
- (1) Deterioration of plank facing on upstream face and crest of dam.
- (2) Presence of a small whirlpool above the upstream face, which indicates a large concentrated leak through the plank facing.
- (3) Absence of plank facing over most of the downstream face and severe deterioration of the plank facing that remains.
- (4) Absence of several timbers from the timber-crib structure and severe deterioration of the timbers that are exposed on the downstream face.
 - (5) Erosion of rockfill on downstream side of dam.
- (6) Large leakage and/or seepage discharge along the downstream toe of the dam, with a large concentration of flow adjacent to the low-level sluice outlet near the center of the dam, and minor concentrations of flow at the ends of the dam adjacent to the gate structures.
- Also, the silt that has accumulated in the reservoir below the crest of the dam may or may not contain pollutants that would cause environmental damage downstream if the dam failed. The southeast abutment gatehouse is open to trespass and is potentially hazardous.
- b. Adequacy of Information. The information available is such that the assessment of the dam must be based primarily on the visual inspection. The visual inspection is adequate to determine the condition of the dam.
- c. <u>Urgency</u>. The recommendations and remedial measures made in 7.2 and 7.3 below should be carried out within one year after receipt of this Phase I inspection report.

d. Need for Additional Investigation. No need exists for additional investigation other than that required to carry out the recommendations made in 7.2 below.

7.2 Recommendations

It is recommended that Glen Road Dam be removed within one year. A Registered Professional Engineer should be engaged to develop a procedure for removing the dam in such a way as to avoid damage downstream. Attention should be given to the silt that has accumulated in the reservoir and to its potential for causing environmental damage downstream. Consideration should also be given to demolishing the gate structures and service bridge.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. Because it is recommended that this dam be removed, there is no need to implement specific operating and maintenance procedures. It is recommended that a surveillance and warning system be established for use in the event of emergency conditions. The debris behind the northwest abutment gate openings should be removed to provide fullflow openings until the dam is removed.

7.4 Alternatives

If a dam is needed at this site, a new one should be designed and built.

APPENDIX A

VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST PARTY ORGANIZATION

| PROJECT Glen Road Dam, NH | DATE <u>November</u> 10, 1978 |
|---------------------------|---------------------------------------|
| | TIME A.M. |
| | WEATHER Cool, partly cloudy |
| | W.S. ELEV. U.S. DN.S. 710.4 396.8 |
| PARTY: | 320 |
| 1. Robert Langen | 6. Ronald Hirschfeld |
| 2. Stephen Gilman | 7. <u>Warren H. Guinan (11/15/78)</u> |
| 3. David Deane | 8 |
| 4. Douglas Ford | 9 |
| 5. Robert Ojendyk | 10 |
| PROJECT FEATURE | INSPECTED BY REMARKS |
| 1. Hydrology/Hydraulics | W. Guinan/D. Ford/R. Langen |
| 2. Soils & Geology | R. Hirschfeld |
| 3. Structural Stability | S. Gilman |
| 4 | |
| | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |

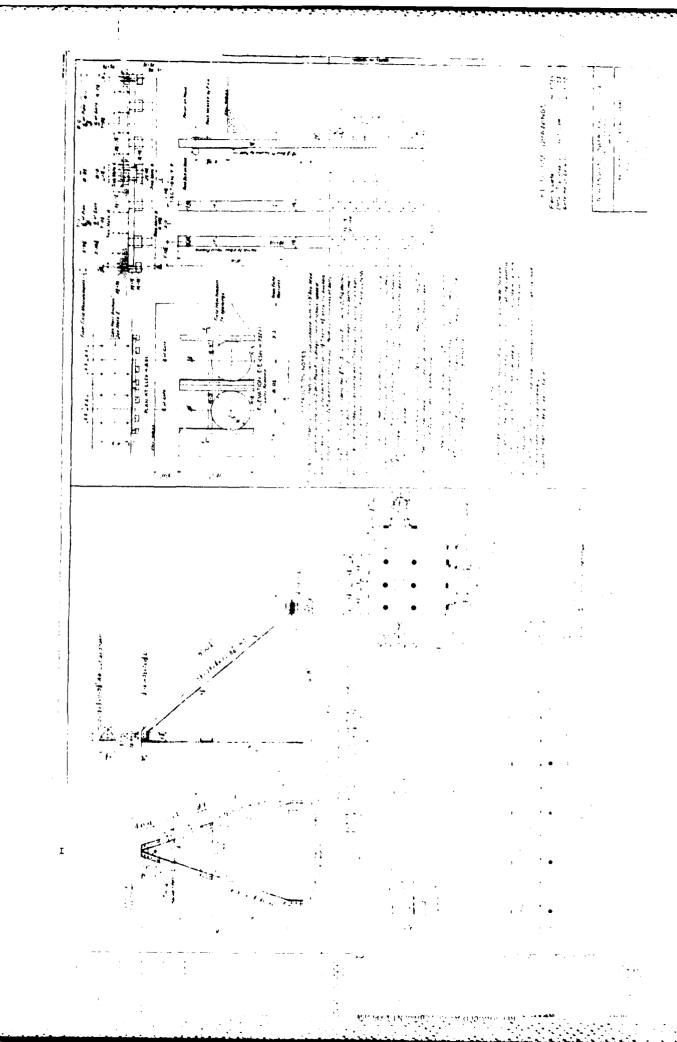
PERIODIC INSPECTION CHECKLIST DATE November 10, 1978 Glen Road Dam, NH PROJECT___ PROJECT FEATURE _____ Dam Embankment _____ NAME _____ DISCIPLINE __ _ NAME __ AREA EVALUATED CONDITION DAM EMBANKMENT Dam consists of rock-filled timber crib. Crest Elevation 710.4' MSL Current Pool Elevation Unknown Maximum Impoundment to Date Not applicable Surface Cracks Pavement Condition Not applicable Crest alignment deviates a few inches Movement or Settlement of horizontally and vertically from a Crest straight line near rockfill washouts close to each end. Lateral Movement See "Movement...of Crest," above. Vertical Alignment See "Movement...of Crest," above. See "Myoement...of Crest," above. Horizontal Alignment Condition at Abutment and Poor. No indication of instability. at Concrete Structures Indications of Movement of None visible. Several parts of timber crib are decayed, other parts have Structural Items on Slopes washed away. Trespassing on Slopes Not applicable Sloughing or Erosion of Not applicable Slopes or Abutments Rock Slope Protection -Not applicable Riprap Failures Not applicable Unusual Movement or Cracking at or Near Toe Seepage discharging at toe of rockfill Unusual Embankment or Downalong entire length of dam, especially stream Seepage severe near sluice at center of dam and near abutments. Piping or Boils Hole eroded backward from toe next to Foundation Drainage Features downstream training wall at southeast abutment. Toe Drains None apparent

Not applicable Not applicable

None

Instrumentation System

Vegetation



PERIODIC INSPECTION CHECKLIST

| PROJECT Glen Road Dam, NH Outlet Works - In | |
|--|---|
| PROJECT FEATURE and Intake Stru | ncture NAME |
| DISCIPLINE | NAME |
| | |
| AREA EVALUATED | CONDITION |
| OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE | Outlet works at northwest abut- ment |
| a. Approach Channel | |
| Slope Conditions | Vertical concrete |
| Bottom Conditions | Not visible |
| Rock Slides or Falls | None |
| Log Boom | None |
| Debris | Clogged with debris |
| Condition of Concrete Lining | Poor, extensive spalling |
| Drains or Weep Holes | None apparent |
| b. Intake Structure | |
| Condition of Concrete | Concrete faced stone - extensive |
| Stop Logs and Slots | spalling Rotted |
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PERIODIC INSPECTION CHECKLIST

| FROJECT Glen Road Dam, NH Outlet Works - | DATE November 10, 1978 |
|--|------------------------|
| Outlet Works - | |
| PROJECT FEATURE Control Tower | NAME |
| DISCIPLINE | NAME |

| AREA EVALUATED | CONDITION |
|---|---|
| OUTLET WORKS - CONTROL TOWER | Northwest Abutment - old power- |
| a. Concrete and Structural | house foundation. |
| General Condition | Fair, mass of structure sound. |
| Condition of Joints | No indication of movement. |
| Spalling | Face of concrete spalling show- |
| Visible Reinforcing | ing stone masonry behind. None |
| Rusting or Staining of Concrete | Limited to area adjacent to embedded iron. |
| Any Seepage or Efflorescence | Significant |
| Joint Alignment | No indication of movement. |
| Unusual Seepage or Leaks in Gate Chamber | |
| Cracks | Extensive alligator cracking. |
| Rusting or Corrosion of Steel | None visible |
| b. Mechanical and Electrical | |
| Air Vents | |
| Float Wells | |
| Crane Hoist | |
| Elevator | |
| Hydraulic System | |
| Service Gates | Wood in deteriorated condition. |
| Emergency Gates | Gate in open position but blocked with wood and debris. Operating |
| Lightning Protection System | mechanism is in fair condition. |
| Emergency Power System | |
| Wiring and Lighting System | |
| | 1 |

PERIOD INSPECTION CHECKLIST

| PROJECT <u>Glen Road Dam, NH</u> Outlet Works - Tr | DATE November 10, 1978 |
|---|---|
| PROJECT FEATURE and Condui | |
| DISCIPLINE | NAME |
| AREA EVALUATED | CONDITION |
| CUTLET WORKS - TRANSITION AND CONDUIT | |
| General Condition of Concrete | Not applicable |
| Rust or Staining on Concrete | Steel penstock - 28' long 5' Ø steel is rusted. |
| Spalling | Not applicable |
| Erosion or Cavitation | None visible |
| Cracking | Surrounding concrete is cracked and spalled. |
| Alignment of Monoliths | Not applicable |
| Alignment of Joints | No indications of movement. |
| Numbering of Monoliths | Not applicable |
| | |
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PERIODIC INSPECTION CHECKLIST

| PROJECT Glen Road Dam, NH Outlet Structure PROJECT FEATURE Outlet Channe | NAME |
|--|---|
| AREA EVALUATED | CONDITION |
| OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL | |
| General Condition of Concrete | Poor |
| Rust or Staining | Some around penstock |
| Spalling | Substantial where concrete in contact with water. |
| Erosion or Cavitation | |
| Visible Reinforcing | None |
| Any Seepage or Efflorescence | Yes |
| Condition at Joints | |
| Drain holes | None apparent |
| Channel | |
| Loose Rock or Trees Overhanging Channel | Some trees, but channel is wide. |
| Condition of Discharge Channel | Bedrock with boulders - fair |
| | |
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| PERIODIC INSPE | CTION CHECKLIST |
|--|--|
| PROJECT Glen Road Dam, NH | DATE November 10, 1978 pillway Weir, |
| Outlet Works - S PROJECT FEATURE Approach & Disch | |
| Channels | NAME |
| DISCIPLINE | NAME |
| | |
| AREA EVALUATED | CONDITION |
| OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS | Sluiceway at center of dam. |
| a. Approach Channel | |
| General Condition | Heavy silting against upstream |
| Loose Rock Overhanging Channel | None |
| Trees Overhanging Channel | None |
| Floor of Approach Channel | Silt |
| o. Weir and Training Walls | |
| General Condition of Concrete | Poor - extensive cracking & spall- ing on training walls. |
| Rust or Staining | None visible |
| Spalling | Yes |
| Any Visible Reinforcing | None visible |
| Any Seepage or Efflorescence | Efflorescence of alligator cracks. |
| Drain Holes | None apparent |
| c. Discharge Channel | |
| General Condition | Good |
| Loose Rock Overhanging Channel | None |
| Trees Overhanging Channel | Trees overhanging channel; chan- nel is wide. |
| Floor of Channel | Bedrock and boulders. |
| Other Obstructions | None |
| | |
| | • |

PERIODIC INSPECTION CHECKLIST PROJECT Glen Road Dam, NH Outlet Works -____ DATE <u>November 10, 1978</u> PROJECT FEATURE Service Bridge ____ NAME __ DISCIPLINE ____ NAME — AREA EVALUATED CONDITION OUTLET WORKS - SERVICE BRIDGE Concrete and wood suspension a. Super Structure Concrete - good Bearings Anchor Bolts Fair - southeast end of suspension bridge loose from bearing. Bridge Seat Treated 4" x 6" - fair Longitudinal Members Underside of Deck Good Secondary Bracing Cables at tower are rusted. Deck Treated wood, fair condition. Not applicable Drainage System Railings None Expansion Joints None Paint None b. Abutment & Piers General Condition of Concrete Good Alignment of Abutment Good Approach to Bridge Good Condition of Seat & Backwall Good Towers - treated wood Good condition Cables Rusted - fair

PROJECT Glen Road Dam, NH DATE November 10, 1978 PROJECT FEATURE Reservoir NAME R. Langen

| AREA EVALUATED | REMARKS |
|---|--|
| | |
| Stability of Shoreline | Good |
| Sedimentation | Major |
| Changes in Watershed Runoff Potential | Some (highway) |
| Upstream Hazards | Railroad bridge |
| Downstream Hazards | Railroad bridge |
| Alert Facilities | None |
| Hydrometeorological Gages Operational & Maintenance Regulations | None at site - U.S.G.S. gage upstream 8.4 miles None |
| | |
| | |
| | |

APPENDIX B
ENGINEERING DATA

MEN HANDSHIRE WADER RESOURCES BOURD

QUESTICONAIRE

MATER POUTE DEVELOPMENTS IN NEW HAMPSHIRE

Frank Chake Com Co

Gentlemen:

We maintain in this office a list of the water power installations in New Hampshire and are frequently receiving inquiries concerning these installations. We are, therefore, bringing this information up to date, and request your cooperation by filling in the questionnaire below with date on your development and return it to us in the enclosed stamped envelope.

If the ownership has changed, will you please forward this questionnaire to the present owners.

Tery truly yours,

Hacker Collecte
Acting Chairman

Dan No. 13 7 12 Location Therman River at America

1. Will you please check or correct:

Jan = 3

| | Our Phin | Your Corrections |
|-----------------------|-------------|---------------------|
| Head - fcet | 73 | |
| Capacity Wheel - H.P. | 2840 | 2140 |
| Generator - K.W. | 1300 | |

2. Is the power plant in operation? Yes

3. If not, is the equipment in operable condition?

4. Is the dam in good repair? Yes

Signed Signed Fres.

Date 2-2-28

NEW HAMPSHIRE WATER CONTROL COMMISSION DATA ON WATER POWER DEVELOPMENTS IN NEW HAMPSHIRE

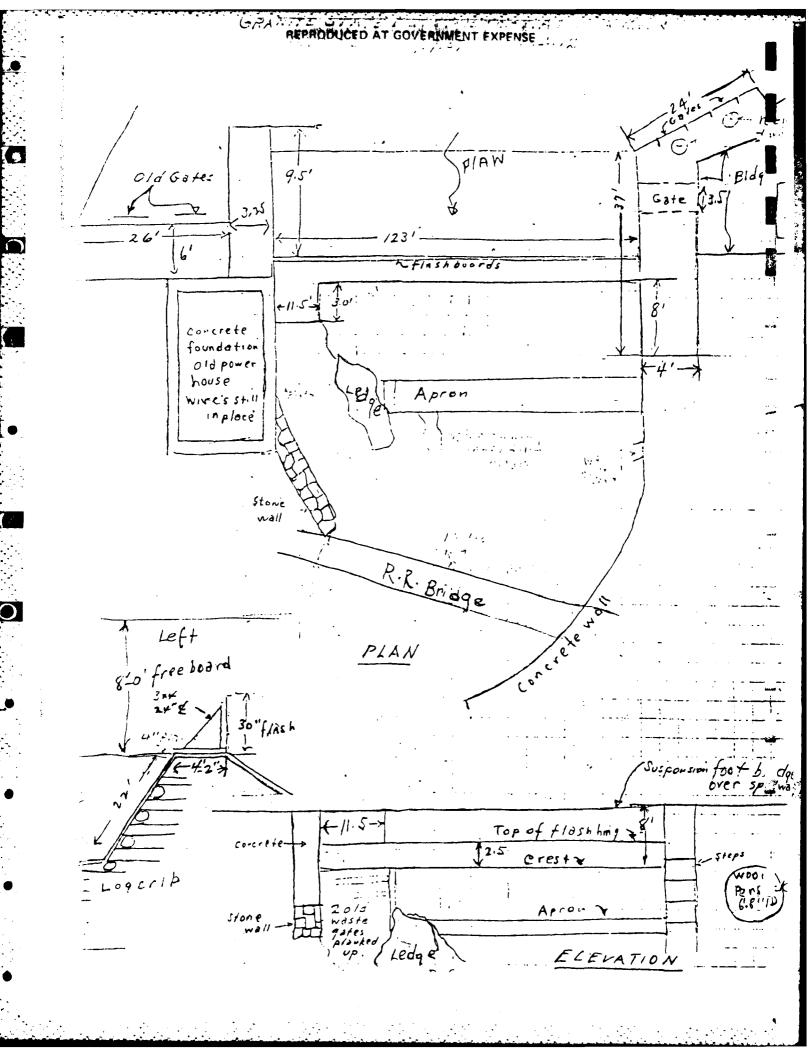
| LOCATION | | AT DAM NO | |
|--|------------------------|---|----------------|
| Town Lebench | | | |
| Stream Kascoma "iver | | | |
| Basin-Primary Conn R | | | |
| Local Name | | ٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠٠ | |
| GENERAL DATA | | | |
| Hend-Max ft.: Wisa | ft.: Ave | 7.3 | ft. |
| Date of Construction | : Use of Pow | er Public Utility | |
| Pondage | ac. ft.: Storage | •••••• | ac. ft. |
| DESCRIPTION | | | |
| Racks | | | |
| Size of Rack Opening | | | |
| Size of Bar | : Material | ••••• | |
| Area: Gross | Sq. Ft.: Net | *************************************** | sq. ft. |
| Head Cates | | | |
| Туре | | ••••••• | |
| Number: Size | ft. high x | | ft. wide |
| Elevation of invert | Total Area | | sq. ft. |
| | | | ····· |
| Hoist | | *********************************** | |
| Hoist Penstock | | | |
| | | | |
| Penstock Number | : Material | | |
| Penstock Number | : Material : Length | Korgan Smith Ver. | |
| Penstock Number | : Material | Morgan Smith Ter. Morgan Smith Terti | cal |
| Penstock Number | : Material | Morgan Smith Ter. Morgan Smith Terti | cal |
| Penstock Number | .: Material | Morgan Smith Ter. Morgan Smith Tertinative 2840 | cal HP |
| Penstock Number Size Turbines Number 3 Rating HP, per unit 2-800 H.P. | .: Material | Morgan Smith Ter. Morgan Smith Tertinative 2840 | cal HP |
| Penstock Number Size Turbines Number Rating HP, per unit 2-800 H P Max. Dement C.F.S., per unit | .: Material | Morgan Smith Ver. Morgan Smith Verticality 2840 | cal HP |
| Penstock Number Size Turbines Number 3 Rating HP. per unit 2-800 H P Max. Dement C.F.S., per unit | .: Material | Morgan Smith Ver. Morgan Smith Verticality 2840 | cal HP |
| Penstock Number Size Turbines Number | .: Material | Morgan Smith Ter. Morgan Smith Tertiacity 2840 | cal HP |
| Penstock Number Size Turbines Number Rating HP. per unit 2-800 H P Max. Dement C.F.S., per unit Type Type Generator Number Number Make 2, G.E. 2300 V 157. | .: Material | Morgan Smith 7er. Morgan Smith 7erti acity 2840 .: Total | cel HP cfs |
| Penstock Number Size Turbines Number Rating HP. per unit 2-800 H P Max. Dement C.F.S., per unit Type Type Generator Number Number Make 2, G.E. 2300 V 157. | .: Material | Morgan Smith 7er. Morgan Smith 7erti acity 2840 .: Total | cel HP cfs |
| Penstock Number Size Turbines Number | .: Material | Morgan Smith 7er. Morgan Smith 7erti acity 2840 .: Total | cel HP cfs |
| Penstock Number Size Turbines Number Rating HP. per unit 2-800 H D Max. Dement C.F.S., per unit Drive Type Generator Number Make 2, G.E. 2300 V 157. Rating KW., per unit 2, 500 Exciter | .: Material | Morgan Smith Ver. Morgan Smith Vertical acity 2540 Total 1-02 2300 7 251 3 acity 1300 / 2-// | HP cfs |
| Penstock Number Size Turbines Number Rating HP. per unit 2-800 HP Max. Dement C.F.S., per unit Drive Type Generator Number Make 2, G.E. 2300 V 157. Rating KW., per unit 2, 500 Exciter Number Number | .: Material | Morgan Smith Ver. Morgan Smith Verti acity 2840 .: Total l=GE 2300 7 251 A acity 1500 / 25/4/ | cal HP cfs |
| Penstock Number Size Turbines Number 3 Rating HP. per unit 2-800 H P Max. Dement C.F.S., per unit Drive Type Generator Number S Make 2, G.E. 2300 V 157. Rating KW., per unit 2, 500 Exciter Number Number Rating-per unit | .: Material | Morgan Smith Ver. Morgan Smith Verti acity 2840 .: Total l=GE 2300 7 251 A acity 1500 / 25/4/ | cal HP cfs |
| Penstock Number Size Turbines Number Rating HP. per unit 2-800 HP Max. Dement C.F.S., per unit Drive Type Generator Number Make 2, G.E. 2300 V 157. Rating KW., per unit 2, 500 Exciter Number Number | .: Material | Morgan Smith 7er. Morgan Smith 7erti acity 2540 .: Total | |
| Penstock Number Size Turbines Number 3 Rating HP. per unit 2-800 H P Max. Dement C.F.S., per unit Drive Type Generator Number 3 Make 2, G. E. 2300 V 157. Rating KW., per unit 2, 500 Exciter Number : M Rating-per unit | .: Material | Morgan Smith Ter. Morgan Smith Tertinative 2840 .: Total l-GE 2300 7 251 Aacity 1300 / 2-7/ | DED R. P. K. W |
| Penstock Number Size Turbines Number 3 Rating HP. per unit 2-800 H P Max. Dement C.F.S., per unit Drive Type Generator Number 3 Make 2, G.E. 2300 V 157. Rating KW., per unit 2, 500 Exciter Number 1 Rating-per unit OUTPUT—KWHRS 10 | .: Material | Morgan Smith Ver. Morgan Smith Vertical acity 2840 Total 1-GE 2300 V 251 A acity 1300 / 2-6/ | 560 R P |
| Penstock Number Size Turbines Number 3 Rating HP. per unit 2-800 HP Max. Dement C.F.S., per unit Drive Type Generator Number 3 Make 2, G.E. 2300 Y 157. Rating KW., per unit 2, 500 Exciter Number Rating-per unit OUTPUT—KWHRS 19 19 | .: Material | Morgan Smith Ver. Morgan Smith Vertical acity 2840 .: Total l=GE 2300 7 281 A acity 1300 // 2-// | HP cfs |
| Penstock Number Size Turbines Number 3 Rating HP. per unit 2-800 H P Max. Dement C.F.S., per unit Drive Type Generator Number 3 Make 2, G.E. 2300 V 157. Rating KW., per unit 2, 500 Exciter Number Rating-per unit OUTPUT—KWHRS 19 19 | .: Material | Morgan Smith Ver. Morgan Smith Verti acity 2840 .: Total l=GE 2300 7 251 A acity 1300 /- 2- // | 550 R.P. K. W |

NEW HAMPSHIRE WATER CONTROL COMMISSION DATA ON DAMS IN NEW HAMPSHIRE

| LOCATION | | STATE NO. 134 | 12 |
|---|---|---|---|
| Town Lepanon . | : County | Grafton | |
| Stream ESSCORE River | | | |
| Basin-Primary Coun R | : Secondary | ascoma R | |
| Local Name Plant No 4 | | | |
| Coordinates-Lat. 73° 70' 11 500 | : Long 720 2. | - 7600 | |
| GENERAL DATA | • | • | |
| Drainage area: ControlledSq. Mi | i.: Uncontrolled | Sq. Mi.: Total 194 | Sq. Mi. |
| Overall length of dam | of Construction | *************************************** | |
| Height: Stream bed to highest elev21.5 | | | |
| Cost—Dam | | | |
| DESCRIPTION Log Crib- Wood- S | | | |
| Waste Gates | | | |
| Type | ······································ | | |
| Number: Size | ft. high x | *************************************** | ft. wide |
| Elevation Invert | : Total Area | | sq. ft. |
| Hoist | *************************************** | · | |
| Waste Gates Conduit | | | |
| Number Ma | terials | ••••••••••••••••••••••••••••••••••••••• | |
| Sizeft.: Length | ft.: Areaft.: | *********************************** | sq. ft. |
| Embankment | | | |
| Type | | | |
| Height—Max. | ft.: Min | | ít. |
| Top-Width | : Elev | | ft. |
| Slopes—Upstreamon | : Downstream | on | |
| Length-Right of Spillway | : Left of Spillway . | | |
| Spillway | | | |
| Materials of Construction | | | |
| Length—Total | ft.: Net123. | <u> </u> | ft. |
| Height of permanent section-Max | | | |
| Flashboards—Type | | | |
| Elevation-Permanent Crest411. | | | • · · · · · · · · · · · · · · · · · · · |
| Flood Capacity 10,455 | cfs.:54 | cfs/sq. mi. | |
| Abutments | | | |
| Materials: Concrete | | | |
| Freeboard: Max 5.0 / | | | ft. |
| Headworks to Power Devel.—(See "Date OWNER Granite State Elec | ta on Power Development' stric Co | ') | |
| REMARKS Hydro Electric Pow | er for Public Util | itr | |
| | | - · • | |
| | | | |
| | | | |
| Tabulation ByA. & J. & R. L. T | Date Lan | 3, 1929, | |

| | WIER CONTROL CONTROLON |
|---------------------|--|
| 1 | E |
| | Concord, New Hampshire |
| | October 14, 1938. |
| | |
| | |
| 1 612 10 | |
| 1000 | |
| | The same of the sa |
| Gil hite Lebinon | Stribe Election, N.H. |
| | RE: Granite State Dam. W. C. C. No.134.12 |
| Gentleme: | 2: |
| | In order that we may determine the magnitude and ex- |
| | the flood of September 21-20 just passed, we are re- |
| | the various dam owners in the State to supply us with owing information: |
| | |
| 1. | Was this dam injured? Ans. No |
| 2. | If so, to what extent? Ans |
| | بينده عن بري معين مستخصيت الدوية ب 4 منت الدين المنت المان والمان المنت المان والمان المنت |
| 3. | Did all flashboards Ams. PRACTICALLY ALL |
| | go out? |
| 4. | What was the maximum Ano. APPROX. 6 FT. |
| | height of water over the permanent crost |
| | of spillway? |
| c | At what day and hour Ans. APPROX. 11 P.M., SEPT. 21 |
| | did the maximum flood |
| | height reach your dam? |
| 5. | Any other interesting information regarding the flood |
| | fall may be given on the back of this sheet, or attach |
| sheets. | |
| | Will you please return this letter with as much in- |
| | on as you can give us as promptly ac possible. A self- ed envelope is attached hereto. |
| | We thank you for your cooperation. |
| | Very truly yours, |
| | Living a Character man |
| | |
| E10:000 | Richard C. Moimpren Chief Engineer |
| Enc. | |

B-4



MEN HAMPSHIRE MATER RESOURCES ECARD

| CAL NAME OF DAM DOWN DESCRIPTION TO THE PROJECT OF DESCRIPTION TO THE PROJECT OF DESCRIPTION TO THE PROJECT OF DESCRIPTION TO BED OF STREAM-FT. 13.4 21.5 TAX. MIN. CONCRETE ABOUT MEAT. CONCRETE ABOUT MAX. DECAL GAGE CONCRETE CONCRETE ABOUT MEAT. CONCRETE | MARKS Cadation MARKS MARKS Cadation MARKS MARKS Cadation MARKS MARK | CONTROL INNE OF DATE OF DATE OF STREAM FOR THE STATE OF STATE OF STREAM FOR THE STATE OF STAT | AM | | | | | | 6,74 |
|---|--|--|--|---|--------------------------|---------------------------------------|----------------|-------------|---------------|
| CAL NAME OF DAM DOWN DESCRIPTION TO THE PROJECT OF DESCRIPTION TO THE PROJECT OF DESCRIPTION TO THE PROJECT OF DESCRIPTION TO BED OF STREAM-FT. 13.4 21.5 TAX. MIN. CONCRETE ABOUT MEAT. CONCRETE ABOUT MAX. DECAL GAGE CONCRETE CONCRETE ABOUT MEAT. CONCRETE | CAL NAME OF DAM! DAMES SALES WE PRODUCE SALES SA | CONTROL PART PRODUCT PROPERTY PROPERTY PROPERTY DESCRIPTION TWO PROPERTY PROPERTY CONCERT ABOUT PROPERTY | ASIN Conn. | erticit | no. | 12 | 134 | . 12 | 17.00 |
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| ### DEVELOPMENT RATED HEAD C.F.S. KW MAKE | NER DEVELOPMENT RATED HEAD C.F.S. | OWER DEVELOPMENT RATED HEAD C.F.S. NITS NO. HP FEET FULL GATE KW MAKE 221 Merganimit Loo 73 See G.E 23 cm/67A - 1240 73 Read Ford | nousire pro | DADLY DY ILE | 1 M255 | . 0 | 0 | <u> </u> | 11 (|
| WER DEVELOPMENT RATED HEAD C.F.S. HEAD C.F.S. KW MAKE 125 Morganismich Line 71 Joo G.E 2100 M.67.4 J Line 71 Roo G.E 2100 M.67.4 J Line 71 Roo G.E 2100 M.67.4 J | RATED HEAD C.F.S. KW MAKE | OWER DEVELOPMENT RATED HEAD C.F.S. NITS NO. HP FEET FULL GATE KW MAKE 1211 Mergan Smith L foo 73 Soo G.E 23 cm x 157.4 3 L 1240 73 ROO G.E 21 cm x 157.4 3 | 100 - (-/ 6 | - 7700F | D 6/8 21 00 | ar res | Ch. M. T | cem meu | TA CORNER |
| RATED HEAD C.F.S. RETS NO. HP FEET FULL GATE KW MAKE 100 73 500 G.E 2306W 657.4 56 1240 73 800 65 2106W 251.4 36 | RATED HEAD C.F.S. ITS NO. HP FEET FULL GATE KW MAKE 211 Morean Smith 2 | RATED HEAD C.F.S. NITS NO. HP FEET FULL GATE KW MAKE 2010 11.5 10. | sor of corr. | Timby a Mile | | | | | |
| 121 1 Morean Smith 500 73 500 G.E 2300 W 187 A 5 1240 73 800 6 E 2200 W 28/A 36 15" 5 Morean Smith | 2 100 73 500 G.E 23.00 V 187 A 5 1240 73 800 GE 23.00 V 187 A 36 1240 73 800 GE 23.00 V 251 A 36 | 1 100 73 500 G.E 23 05 167 A 3 1 1240 73 800 G.E 23 05 X 167 A 3 1 1240 73 800 G.E 2200 X 251 A 31 | | <u>FEET FUI</u> | | KW | | MAKE | |
| 1215 Mecens Smith 500 73 500 G.E 2306 V 1874 5 1240 73 800 6 E 2200 V 2814 36 25° 5 Mecens Smith | 2 100 73 500 G.E 2300 V 157 A 36 1240 73 800 6 2200 V 251 A 36 | 1 100 73 500 G.E 23 05 167 A 3 1 1240 73 800 G.E 23 05 X 167 A 3 1 1240 73 800 G.E 2200 X 251 A 31 | 56- | | | | | | |
| 2 100 73 500 GE 2306 W 167 A 36 1 1240 73 800 GE 2200 W 25/A 36 35° 5 Marca 20 Smith | 1 1240 73 500 G.E 2306 W 167 A 36 1240 73 800 GE 2200 W 25/A 36 | 1 12.40 73 Soo G.E. 23.06 V (67.4. 3) 1 12.40 73 800 GE 23.06 V 25/A 3) | | • | | | | 21 S. More | ansmith |
| 1240 73 800 GE 2200 X 25/A 36 | 1240 73 ROO GE 2200 X 25/A 36 | 12.40 73 ROO GE 2200 X 35/A 31 | 7 50 | 0 73 | | 500 | 10 | 7.E 2306 | W/574 3 |
| E Hydro Electric Domer for Public Vtility 35"5 Margan Smith | E Hydra Electric power for Public Utility (35° 5. Margan Smile | SE Hydro Electric power for Public Vtility 35 5. Margan South | 1 12 | 40 73 | | | | F 2300K | 25/4 36 |
| E Hydra Electric Dower for Public Villity | E Hydra Electric power for Public Utility | SE Hydra Electric power for Public Vtility | | | | | . 7 | 5" 5 Mar | edo Said |
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| MARKS Primary # 90% time 149.5 Tailmater .5 mi from mouth Ma | MARKS Primary & 90% time 149.5 Tailwater .5 mi from mouth MA | The At land of the world the first of the form marker in | P Part | ALLOCK ROOM | NAVE OF | The Contract | inlier. | | XXXXX |
| 800 ft lang penstack wood stave 6.8 "inside diameter Cosses River | 100 ft lang penstack wood stave 6.1 "inside diameter, Cosses River | 100 ft long penstock wood stave 6.2" inside diameter (cosses River | K ACTORE - Q | desections lig | AT BAOK | | 77. L | .Tup pec | + Love E |
| React lang peristack wood stave be "inside diameter Crosses River of Relidate - aprese down right hank Talked to S.T. Tupper, Chief | Reday - gover down right hank Talked to S. I. Tupser, Chief | 1800 ft long penstock wood stave 6.1" inside diameter Crosses River of R. Reldae - goeses down right hank. Talked to S.T. Tupper, Chief | s date tutocora | zinen installa | Ben Alles | SYS MAKIN | MUD 0 87 | grande | aareci |
| Reduce - goese: John right hank. Tolked to S.I. Tupper, Chief R. Reidge - goese: John right hank. Tolked to S.I. Tupper, Chief R. Raxe intermetion on installation. Also says maximum oftenable gover | R. Acidge - goese: Jona right hank. Tolked to S.I. Tupper, Chief L. Bardge - goese: Jona right hank. Tolked to S.I. Tupper, Chief L. Faxe intermetion on installation. Also says maximum oftenable homes. | 1800 ft long penstock wood stave 6.8" inside diameter (cosses River). R. Bridge - goeses down right hank. Tolked to S.I. Tupper, Chief Le gave intermation on installation. Also seve maximum elternable downer. | DIO AP WHITE FOI | ed at 2040 AP | Redere | lop ment o | F0/0 | Station | ordom |
| Reduce - goese: John right hank. Tolked to S.I. Tupper, Chief R. Reidge - goese: John right hank. Tolked to S.I. Tupper, Chief R. Raxe intermetion on installation. Also says maximum oftenable gover | R. Acidge - goese: Jone right hank. Tolked to S.I. Tupper, Chief R. Acidge - goese: Jone right hank. Tolked to S.I. Tupper, Chief 2. Pare intermetion on installation, Also says maximum oftenable do ner in | 1800 ft lang penstack wood stave 6.8" inside diameter (cosses liver of R. Reidge - gasses down right hank. Tolked to S.I. Tupper, Chief e gave intermetion on installation. Also sevs maximum of tolable hance i | io effective ne | do both unit. | בחוחחחון: | | | | |
| Reduce - goese: John right hank. Tolked to S. I. Tupper, Chief. R. Ridge - goese: John right hank. Tolked to S. I. Tupper, Chief. R. Ridge of the S. I. Tupper, Chief. R. Ridge of the service of the ser | R. Acidge - goese: Sono right hank. Tolked to S. I. Tupper, Chief. 2. Pare intermetion on installation. Also says maximum offernable agree in | Read to long penstack wood stave bis "inside diameter. States River of R. Bildge - gasses down right hank. To led to S. T. Tupper, Shiet to e gave information on installation. Also sers maximum of temple power in the proper of the power of | * | | , | • | | | |
| Reduce - goese: John right hank. Tolked to S. I. Tupper, Chief. R. Ridge - goese: John right hank. Tolked to S. I. Tupper, Chief. R. Ridge of the S. I. Tupper, Chief. R. Ridge of the service of the ser | R. Acidge - goese: Sono right hank. Tolked to S. I. Tupper, Chief. 2. Pare intermetion on installation. Also says maximum offernable agree in | 1800 ft lang penstack wood stave 6.8" inside diameter (cosses liver of R. Ridge - goese: John right hank. Tolked to S.I. Tupper, Chief e. gave intermation on installation. Also save maximum of topicable borner | | | | | | | |
| R. Holdge - gaese: Jona right hank. Tolked to \$1. Tupper. Chief. | R. Acidge - goese: Sono right hank. Tolked to S. I. Tupper, Chief. 2. Pare intermetion on installation. Also says maximum offernable agree in | Reduce - goese: John right hank. Tolked to S.I. Tupper, Chief R. Reidge - goese: John right hank. Tolked to S.I. Tupper, Chief R. Raxe intermetion on installation. Also says maximum oftenable gover | | | | | | | |
| Realth and peristack wood stave bil "inside diameter" (cosses Ruse in Relate - gasses some right hank. Tolked to \$1. Tupper, which e faxe information an installation. Also says maximum offenable power in the power | R. Acidge = gaeses sono right hank. Tolked to \$1. Tupper, which experiences in the fank. Tolked to \$1. Tupper, which experiences installation. Also says maximum offernable power is in its while roted at 2040 ff. Redevelopment of old Station at doming refrective head both units running. | Realth lang peristack wood stave bil "inside diameter. Classes River a. R. Beldge - gaese some right hank. Tolked to S. T. Tupper, Shiet e gave information an installation. Also says maximum offernable power is the power of the state of all station at dome or effective head. both units running | | | | | | | |
| R Bridge - goese: John right hank. Tolked to S.I. Tupper, Chief L. Fare intermetion on installation, Also says maximum oftenable hower. | Reliance peristant wood stave bil "inside diameter" (cosses River of Reliance of another sound right bank. Tolked to \$1. Tupper, Shiet equipment installation. Also says maximum offernable power in the power of while roted at 2040 ff Redevelopment of old Station at domine effective head both units running. | Relate = goese son right hank. Tolked to \$1. Tupper, Sheet e governation an installation. Also says maximum offernable power is a power of of old Station at dome of fective head both units running. | .:E 1937 | PS C | | | | | ŅΥ |

9/7/37 2000

APPENDIX C
PHOTOGRAPHS

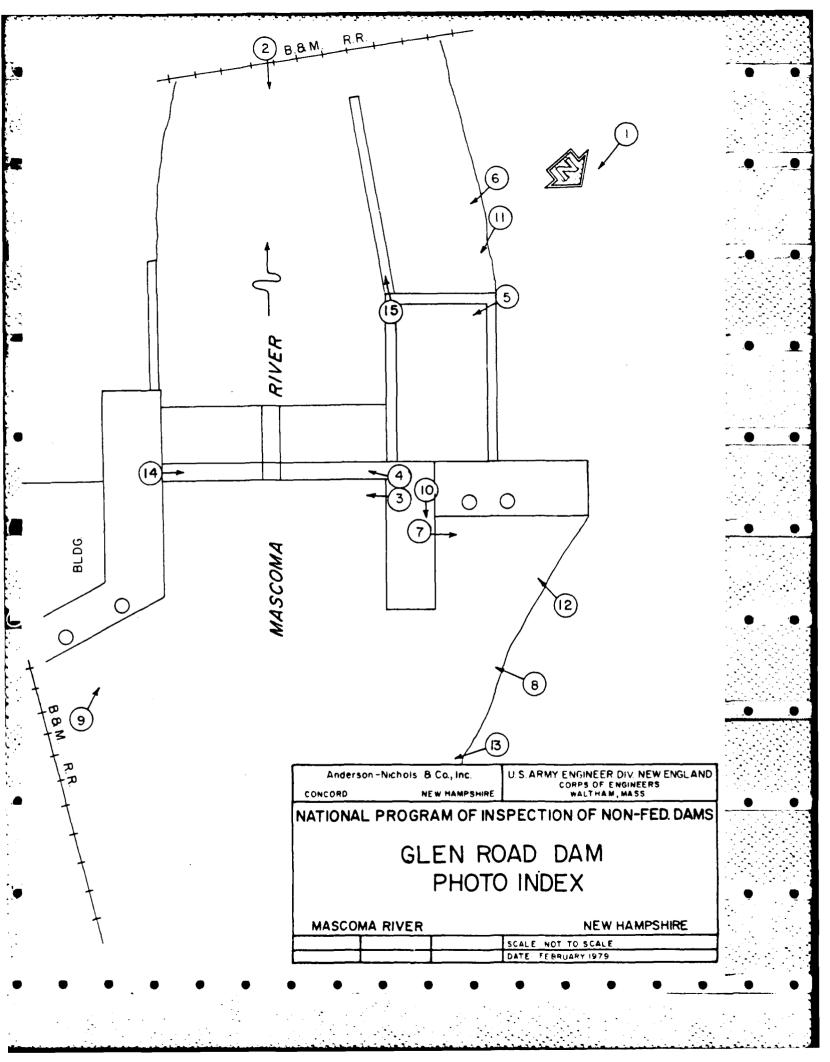




Figure 2 - Looking at the downstream face of the dam.



Figure 3 - Looking across upstream face of crest of the dam at the gatehouse.



Figure 4 - Looking across the crest of the dam.



Figure 5 - Looking across the downstream face of the dam.

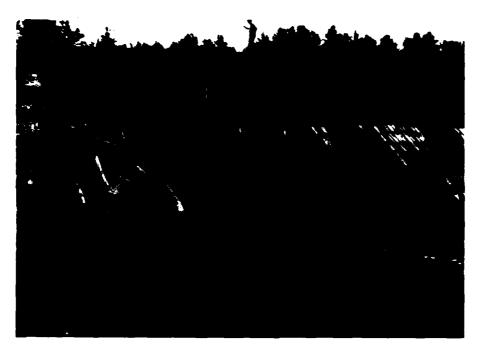


Figure 6 - Looking at northwest end of the dam.



Figure 7 - Closeup view of debris in front of gates to old powerhouse at the northwest abutment of the dam.

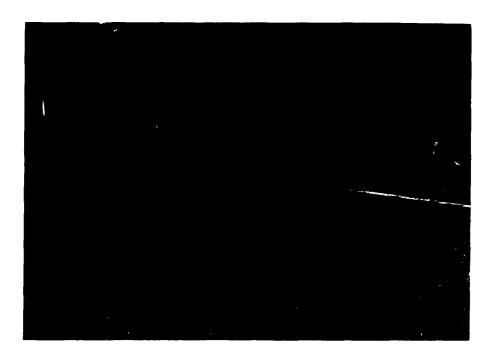


Figure 8 - Looking at gate structures and upstream face of the dam.

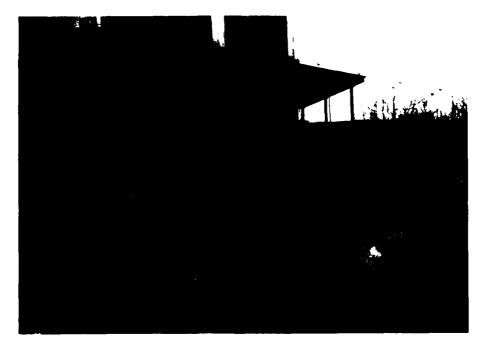


Figure 9 - Looking at gatehouse and intake structure for inoperative penstock.



Figure 10 - Closeup view of spalling concrete on northwest abutment gate structure.

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Figure 11 - Looking at penstocks to old powerhouse at the northwest end of dam.



Figure 12 - Gate controls for old powerhouse at the northwest abutment of the dam.



Figure 13 - Looking across the gatehouse service bridge from the southeast abutment.

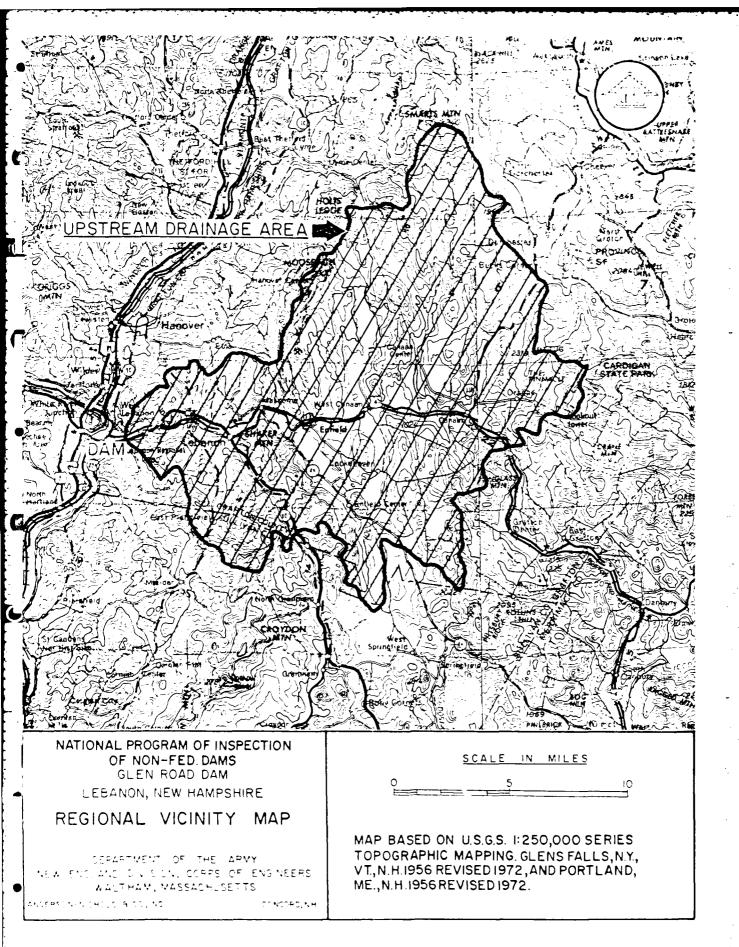


Figure 14 - Looking upstream from the northwest river bank.



Figure 15 - Looking downstream from the northwest abutment.

APPENDIX D
HYDROLOGIC AND HYDRAULIC COMPUTATIONS



APPENDIX D

GLEN RORD DAM (MASCONA DAM NO. E)

TEST FLOOD = 14 PMF

SPECULATE PIME USING PRELIMENTRY GUIDANCE FOR FORFILE DISCHARGES IN THREE I DAM SAFETY INVESTIGATIONS, MARCH 1975.

PARAGE STOPE OF THE WATERSHED IS 29 FT/MI. OUR TO
MASCOMA LAKE, LOCATED APPROXIMATELY 9 MILES
UPSTREAM OF THE DAM AND STHER STORAGE AREAS
FURTHER UPSTREAM THE FLAT & CONSTHL' CURSE
WELL HE USED TO LOMPUTE THE PIME

PMF=193 M== X 328 C5M = 63,304 CFS

19 PMF = 63,304 = 15,826 CFS

TEST FLOOD DISCHERGE = 15, 826 CFS
REFER TO RATING CURVE: (D.3)

VISTH A DISCHARGE OF 15,836 CFS AN ELEVATION CF 121.8 1954 IS READ SPILLWAY CRESTED POLY

HATELY J. T. FEET DURING THE TEST FLOWD (1/4 EASENELS)

DETERMENTS DESCHARGE RATENS CORVE FOR THE DAM JOHNS THE WEIR EQUATIONS Q= CLH^{3/2}, WHERE THE C FOR THE DAM SPIZZWAY CREST IS 3.8, 'C' OVER REUTINENTS AND OVERBANKS IS 2.6.

TRIAL #1 @ 912.1 SPILLWAY CREST

TRIAL #2 @ 913.0 $Q = 3.8 (123) (0.9)^{3/2} = 399 \text{ CFS}$

72712 #3 @ 415.0 Q = 3.8 (123)(2.9) = 2308 c=5

D= 3.3(123)(6.9) 3/2 = 8472 CFS

 $Q = 3.8(123)(8)^{3/2} + 2.6(55)(1.1)^{3/2} + 2.6(61)(1.6)^{3/2} = 11,062 \text{ cfs}$

7R = AL = 6 + 922.0 $Q = 3.8(123)(9.8)^{3/2} + 2.6(55)(3)^{3/2} + 2.6(61)(3.5)^{3/2} + 2.6(17)(2.0)^{3/2} = 16,466 \text{ cfs}$

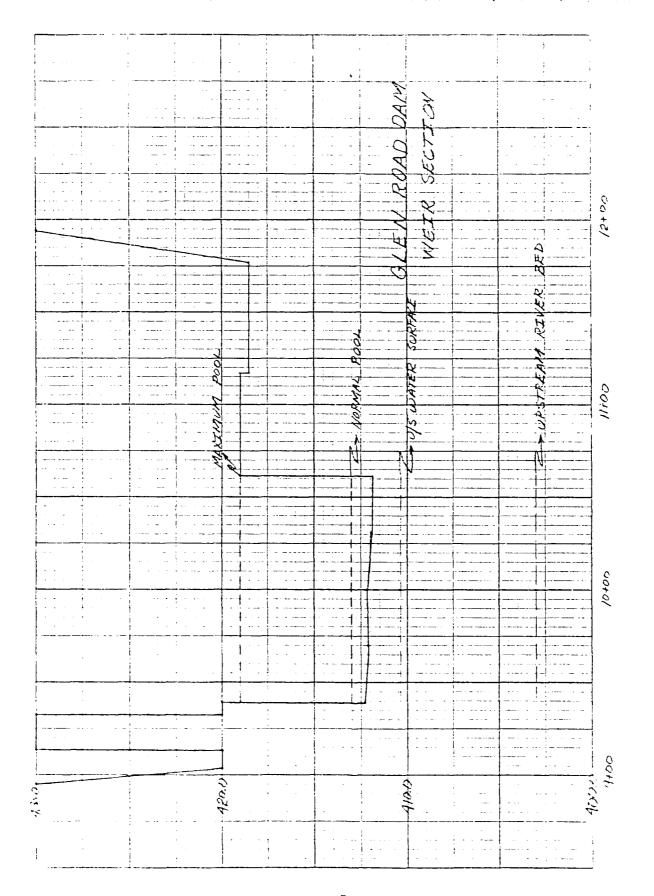
TRIAL #7 & 427.0 $Q = 3.8(123)(14.9)^{3/2} + 3.6(55)(8.0)^{3/2} + 2.6(6)(9.5)^{3/2} + 2.6(6)(9.5)^{3/2} + 2.6(6)(9.5)^{3/2}$ $+ 2.6(17)(7.0)^{3/2} = 34,867 \text{ of } 5$

VOE THE REDGE TRINLS TO DEVELOP A DESCHARGE RATER & CURVE FOR THE SAEN ROAD DAM.

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July 1 PAZ DELL

EREFOR ANALYSIS - TO DETERIATIVE DOWNSTREAM

JORNAL FOR LUSTING MEAN ANNUAL FLOW; USTING

LATER RESOURCES DATA FOR NEW HAMPSHIRE AND

VERNOUT, VIATER YEAR 1976, U.S. GEOLOGICAL SURVEY:

DITA REPORT MH-VT-76-1, AUGUST 1977:

AT GAGE STATIONS ON MASCOMA RIVER

DA=80.5 MIZ - MEAN ANNUAL FLOW= 167 CFS=2.07 CM.

UK=153.0 MIZ-MEAN ANNUAL FLOW=323 CFS=2 11 CM.

DUE TO THE UPSTREAM STORAGE OF MASCONDA LANE, A.

ZILL USIN MALUE IS APPLIED TO DA E COMMINIS DAM.

(DA=193 MIZ): MEAN ANNUA FLOW = 193 X 2.11=407 CFS

THES GIVES ABOUT DIFFORD DEPTH OVER THE SPICENEY.

 $Q_{p} = \frac{8}{27} \text{ Wr} \sqrt{6} \text{ Up}^{\frac{5}{2}}$ $W_{b} = \frac{8REACH}{4NIDTH}$ $Q = 32.2 \text{ FT/SEC}^{2}$ $U_{0} = \frac{700C}{4NEV} \text{ ELEV-U/S RIVER BED}$

415.0' MS. OR 0.9' OVER SPILLWAY CREST. UPSTREAM
PIVER BED SHOWN ON PLANS = 403' ANTHE DAY
OF THSPECTION SEDIMENTATION WAS OBSERVED.
SOME OF THIS SEDIMENTATION MAY BE CONSOLIDATED HOWEVER THE MOST LONSERVATIVE YOUR LITTLE BE USED.

2 GIEN PORT CAM 1/6 = 122' 1 0.40 = 19, FT 40 = 4/3,0 - 403.0 = 10. FT

O OVER THE THEO PREACHED BREES Q=38/H) 02 F 140 VI

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| | |
| FOR MANTIONA POOL: MANTIMUM POOL FLEVATION = 180 | |
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| 2, 2. EN RIKE DAM | |
| 1 = 43 FT | |
| Un= 4/9-403 = 16 FT | |
| | |
| | |
| FROM FOLETION: Q=5273CFS | |
| Q DIEZ DEM OTHER THAN BREAGHED AREA: 3.8(74)(6.3) 3/2 5097045 | |
| | |
| | |
| 7376 BREACH OF = 5273 + 5377 = 10,370 CFS | |
| | |
| | <u> </u> |
| REACH #1 | |
| | |
| DEE A TYPICKE CROSS SECTION ALONG THE DOWN: | |
| CREAM REACH FROM THE DAM TO THE SECTEON | |
| 1200 FT DOWNSTREAM | |
| • | |
| $Q = \frac{1.4^{\circ}}{h} F R^{2/3} S^{1/2}$ | |
| | |
| N = COMPOSITE "N' VHIVE | (. : |
| A= AKER OF SECTION | |
| P= A/P (WETTER FEX = CRETER) | |
| | |
| S= SLOPE OF REACH | |
| | |
| LENGTH OF PEACH = 1200 FT . | |
| ILEIHTEUI G IS TOE = 402 | |
| | |
| ELESETEDING END OF REACH = 3% | |
| SW-E=0.01 | |
| 604805775 N = 12075 | |
| | |
| | |
| $T \mathcal{L} = 1 \mathcal{L} = 1$ STAGE = 1.0' $Q = \frac{1.99}{0.075} \cdot 92 \cdot \frac{92 \cdot (92)}{(92.9)} \cdot \frac{12}{(0.01)^2} = 120 \text{ FFS}$ | |
| Q= 1.4/0.075 · 92 · (1.19.5) (0.01) = 180 ·FS | |
| | |
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| | • |
| | |
| D-7 | |
| | |

TOTAL BREAKH DE 2015 + 290= 2895 (FE

78=1.2 = 2 = 746 = 3.0' Q=1.970.075 · 288 · (285/103.5) · (0.01) = 1132 cis D= 1.1%,075.500. (500/112.5) 3 (0.01) = 2685 c=5 STABE = 70' 0 = 1.49/0.075 · 776 · (776/168.5) · (0.01) = 4267 cfs STAGE = 10.0' D= 1.49/0.075 . 1900 · (1400/253) · (0.01) = 8701055 STACE= 12.0' W= 1.49/0.075 . 1956. (1956/309) 3.(0.01) = 1227/CFS USE THE ABOVE TRIALS TO ESTABLISH A INCLUSTREAM Y-SECTION PATION CURVE FOR NORMAL POOL: BREACH DD = 2845 CFS -> STAGE = 5.4" WISTAGE = 5.9' VOLUME = // AC-FT REEACH QD. (TRIAL) = 2895 (1- 11) = 180205-5TAGE: 9.0' WISTAGE = 4.0' VOLUME = 7 AC-FT BREACH Q, = 2895 (1-(11+7)/2)=1992CFS - STAGE= 4.2' INTECEDENT 0=407 CFS -> STAGE = 1.5 : THE TUCKERSE IN STAGE LAUSED BY A EKEACH AT NORMAL POOL WOOLD BE = 2.7 FEET. FOR MAJIMINA POOL;

| BREACH OF, = 10,370 ors - 574.45 = 10.8 | |
|---|--------------|
| | <u> </u> |
| W/STATE 10.8' VOLUME = 7 AC-FT | • |
| WESTER VOLUME TO REFER TO SEE | |
| BREACH DE (THIN)= 10270 (1- 70)= 9/60 CFS -STAGE= 10.2' | |
| | |
| W/37HGE=10.2/ Vacunge=3 AS-FF | |
| 2FERICH DE = 10370 (1- (7+3)/2)= 9505 00 -> STAGE = 10.4' | |
| - 281/21 12 = 103/01 - 60)- 7303 65 -31/466 = 10.9 | |
| | |
| | |
| ANTECEDENT Q= BA72 CFS - STAGE = 9.8' | |
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| | |
| THE INCREASE IN STAGE CAUSED BY A BREKER | |
| · · · · · · · · · · · · · · · · · · · | |
| FT MAITHUM POOL WOULD BE = 0.6 FEET. | |
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| REACH #2 | |
| REHUM TO | |
| | |
| USE A TYPICAL CROSS SECTION ALONG THE DOWN- | |
| STREAM REACH FROM THE DAM TO THE SECTION | |
| | . . . |
| SIFERM REACH THE DAILY TO THE SECT FOR | |
| | |
| 2800' DOWNSTREAM. | |
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| | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=135'12 | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=135'12 | |
| 2800' DOWNSTREAM. O= 1.9°/n AR=13 5'12 LENGTH OF REACH= 1600 FT (2800-1200) | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=135'12 | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=13 5'12 LENGTH OF REACH= 1600 FT (2800 - 1200) ELEIATION (0, REGINISTN: OF REACH= 390 | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=135'12 LENGTH OF REACH= 1600 FT (2800-1200) | |
| LENGTH OF REACH= 1600 FT (2800-1200) ELEIATION (Q. REGINNING OF REACH= 390 ELEVATION) (Q. END OF REACH= 370 | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=13 5'12 LENGTH OF REACH= 1600 FT (2800 - 1200) ELEIATION (0, REGINISTN: OF REACH= 390 | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=13 5"12 LENGTH OF REACH= 1600 FT (2800-1200) ELEVATION (O, REGINNING OF REACH= 390 ELEVATION (C, END OF REACH= 370 SLOPE= 0.0125 | |
| LENGTH OF REACH= 1600 FT (2800-1200) ELEIATION (Q. REGINNING OF REACH= 390 ELEVATION) (Q. END OF REACH= 370 | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=13 5"12 LENGTH OF REACH= 1600 FT (2800-1200) ELEVATION (O, REGINNING OF REACH= 390 ELEVATION (C, END OF REACH= 370 SLOPE= 0.0125 | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=135'12 1.ENGTH OF REACH= 1600 FT (2800-1200) ELETATION (Q. REGINNING OF REACH= 390 ELEVATION) (Q. END OF REACH= 370 SLOPE= 0.0125 UMPOSITE 'n' = 0.075 | |
| 2800' DOWNSTREAM. $Q = \frac{1.4^{\circ}}{n} AR^{=13} S^{1/2}$ LENGTH OF REACH= 1600 FT (2800-1200) ELETATION (a. RESIDIATING OF REACH= 390 ELEVATION) (a. END OF REACH= 370 SLOPE= 0.0125 LUMPOSITE $n' = 0.075$ | |
| 2800' DOWNSTREAM. $Q = \frac{1.4^{\circ}}{n} AR^{=13} S^{1/2}$ LENGTH OF REACH= 1600 FT (2800-1200) ELETATION (a. RESIDIATING OF REACH= 390 ELEVATION) (a. END OF REACH= 370 SLOPE= 0.0125 LUMPOSITE $n' = 0.075$ | |
| 2800' DOWNSTREAM. O= 1.4°/n AR=135'12 1.ENGTH OF REACH= 1600 FT (2800-1200) ELETATION (Q. REGINNING OF REACH= 390 ELEVATION) (Q. END OF REACH= 370 SLOPE= 0.0125 UMPOSITE 'n' = 0.075 | |
| 2800' DOWNSTREAM. $Q = \frac{1.4^{\circ}}{n} AR^{=13} S^{1/2}$ LENGTH OF REACH= 1600 FT (2800-1200) ELEIATION (a) RESIDING OF REACH= 390 ELEVATION (a) END OF REACH= 370 SLOPE= 0.0125 UNAPOSITE $n' = 0.075$ | |
| 2800' DOWNSTREAM. $Q = \frac{1.4^{\circ}}{n} AR^{=13} S^{1/2}$ LENGTH OF REACH= 1600 FT (2800-1200) ELEIATION (a) RESIDING OF REACH= 390 ELEVATION (a) END OF REACH= 370 SLOPE= 0.0125 UNAPOSITE $n' = 0.075$ | |
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| 2800' DOWNSTREAM. $Q = \frac{1.4^{\circ}}{n} AR^{=13} S^{1/2}$ LENGTH OF REACH= 1600 FT (2800-1200) ELEIATION (a) RESIDING OF REACH= 390 ELEVATION (a) END OF REACH= 370 SLOPE= 0.0125 UNAPOSITE $n' = 0.075$ | |
| 2800' DOWNSTREAM. $O = \frac{1.4^{\circ}}{n} A R^{=12} S^{1/2}$ LENGTH OF REACH = 1600 FT (2800 - 1200) ELE (ATTON) (2), REATHINGS OF REACH = 390 ELEVATION (2) END OF REACH = 370 SLOPE = 0.012 S UMAPOSITE 'n' = 0.075 TRIPLE #1 STAGE = 1.0' $O = \frac{1.9^{\circ}}{0.075} \cdot 89 \cdot \frac{8^{4}}{99} \cdot \frac{10.0125}{0.0125} = 190.075$ | |
| 2800' DOWNSTREAM. $Q = \frac{1.4^{\circ}}{n} AR^{=13} S^{1/2}$ LENGTH OF REACH= 1600 FT (2800-1200) ELETATION (a. RESIDIATING OF REACH= 390 ELEVATION) (a. END OF REACH= 370 SLOPE= 0.0125 LUMPOSITE $n' = 0.075$ | |
| 2800' DOWNSTREAM. $O = \frac{1.4^{\circ}}{n} A R^{=12} S^{1/2}$ LENGTH OF REACH = 1600 FT (2800 - 1200) ELE (ATTON) (2), REATHINGS OF REACH = 390 ELEVATION (2) END OF REACH = 370 SLOPE = 0.012 S UMAPOSITE 'n' = 0.075 TRIPLE #1 STAGE = 1.0' $O = \frac{1.9^{\circ}}{0.075} \cdot 89 \cdot \frac{8^{4}}{99} \cdot \frac{10.0125}{0.0125} = 190.075$ | |
| 2800' DOWNSTREAM. $O = \frac{1.4^{\circ}}{n} A R^{=12} S^{1/2}$ LENGTH OF REACH = 1600 FT (2800 - 1200) ELE (ATTON) (2), REATHINGS OF REACH = 390 ELEVATION (2) END OF REACH = 370 SLOPE = 0.012 S UMAPOSITE 'n' = 0.075 TRIPLE #1 STAGE = 1.0' $O = \frac{1.9^{\circ}}{0.075} \cdot 89 \cdot \frac{8^{4}}{99} \cdot \frac{10.0125}{0.0125} = 190.075$ | |
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| | 0-150/100- 276 /276/10-) | |
| | STAGE = 3' Q= '51/0.075 · 276 · (279/105) · (0.0125) = 1/60 CF= | |
| | | |
| TITAL #3 | STAGE = 5' | |
| | STAGE = 5' Q=1.4%,075 · 500 · (500/121) 2/3 · (0,0125) = 38: : 45 | - |
| | | |
| | STAGE= 7' Q=1.99/0.075.760.(760/161) 2/3. (0.0125) 12 1750 CFS | |
| - TRIFIC TY | 5/7/Gt= 1/3 / \12 | , |
| · · · · · · · · · · · · · · · · · · · | Q=11/0,075.760-(161) - (0.0125) = 475) CFS | |
| | | |
| TRIFILE | STAGE = 10' D=1.99/0075 · 1300 (1300) 261) · (0.0175) = 841/1111 | |
| | D=1.99/2 075 1200 /300/201 = 00120 = 001201 | |
| | C 10013 100 (0.01.0) 01.1 | |
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| TITELLO | STAGE = 12. | |
| | STAGE = 12' Q=1.99/0.075.1760.(1760/302).(0.0125)=12/12.000 | |
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| USE THE | ABOJE TREACS TO ESTABLISH A DOWN!- | |
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| ZEEL BREL | CH OP = 1992 (FS - STAGE = 4.0' W/STAGE = 4.0' VOLUME = 9.0 AC-FT CH OP (TRIAL) = 1992 (1- 30-9) = 1/38 CFS + STAGE = 3.0' | |
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| BEEL BREL BREL | CH OP = 1992 (FS - STAGE = 4.0' W/STAGE = 4.0' VOLUME = 9.0 AC-FT CH OP (TRIAL) = 1992 (1- 30-9) = 1/38 CFS + STAGE = 3.0' | |
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| EEST BREA BREA ANTO | CH OP = 1992 OFS - STAGE = 4.0' W/STAGE = 4.0' VOLUME = 9.0 AC-FF RCH OP3 (TRIAL) = 1992 (1-30-9) = 1/38 OFS + STAGE = 3.0' W/STAGE = 3.0' VOLUME = 5.0 AC-FF GCH OP3 = 1992 (1- (9+5)/2) = 1328 OFS -> STAGE = 3.2' | |
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| ANTESEDE | 1012 O= 8472 GFS 7 STAGE - 10.0' | |
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| SE A TY COMMETTEE SECTION | PICAL CROSS SECTION ALONE THE FIN REACH FROM THE DAM TO THE 4300' DOWNSTREAM $Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$ | |
| LENGTH C | PICAL CROSS SECTION ALONE THE FIND REACH FROM THE DAM TO THE 4300' DOWNSTREAM $Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$ OF REACH = 1500 FT (4300 - 25.00) CHE @ BEGINNING OF REACH = 370 | |
| SE A THE CONNETTED SECTION LENGTH OF ELEVATION ELEVATION | PICAL CROSS SECTION ALONE THE FROM REACH FROM THE DAM TO THE 4300' DOWNSTREAM $Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ OF REACH = 1500 FT (4300 - 25.00) ON O BEGINNING OF REACH = 370 ON OF REACH = 25.3 | |
| SE A THE COUPE = | PICAL CROSS SECTION ALONE THE FIN REACH FROM THE DAM TO THE 4300' DOWNSTREAM $Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$ OF REACH = 1500 FT (4300 - 28.00) ON @ BEGINNTNE OF REACH = 370 ON WEND OF REACH = 353 | |
| SE A THE COUPE = | PICAL CROSS SECTION ALONE THE FROM REACH FROM THE DAM TO THE 4300' DOWNSTREAM $Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ OF REACH = 1500 FT (4300 - 25.00) ON O BEGINNING OF REACH = 370 ON OF REACH = 25.3 | |
| SE A TYPE DEVINETEE SECTION LENGTH OF ELEVATION COOPER OUTGEOST | PICAL CROSS SECTION ALONG THE FIN REACH FROM THE DAM TO THE 4300' DOWNSTREAM $Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ OF REACH = 1500 FT (4300 - 25,00) CHI Q BEGINNING OF REACH = 370 CHI Q END OF REACH = 353 C.0.133 | |
| SE A TYPE DEVINETEE SECTION LENGTH OF ELEVATION COOPER OUTGEOST | PICAL CROSS SECTION ALONG THE FIN REACH FROM THE DAM TO THE 4300' DOWNSTREAM $Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ OF REACH = 1500 FT (4300 - 25,00) CHI Q BEGINNING OF REACH = 370 CHI Q END OF REACH = 353 C.0.133 | |
| SE A TYPE DEVINETEE SECTION LENGTH OF ELEVATION COOPER OUTGEOST | PICAL CROSS SECTION ALONG THE FRINT REACH FROM THE DAM TO THE 4300' DOUDISTREAM $Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ OF REACH = 1500 FT (4300 - 25,00) CUL @ BEGINNING OF REACH = 370 CUL @ END OF REACH = 25.3 C.0123 | |
| SE A TYPE DEVINETEE SECTION LENGTH OF ELEVATION COOPER OUTGEOST | PICAL CROSS SECTION ALONG THE FIN REACH FROM THE DAM TO THE 4300' DOWNSTREAM $Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$ OF REACH = 1500 FT (4300 - 25,00) CHI Q BEGINNING OF REACH = 370 CHI Q END OF REACH = 353 C.0.133 | |

77=72 = 2 STAGE = 2' Q = 1.90 | 0.075 · 204 · (204/106) · (0.0122) = 723 crs STHGE = 3.5' ()=1.49/0.075 - 362. (362/110) 13. (0.0123) 12 /255 55 STAGE = 5' TRIAL #9 0=1.44/0.075.824.(324/389) 3.(0.0133) =3/40 CFE STAGE = 10' Q=1.96/0,075.2150. (2150/684) 1/3 (0,0133) = 10,583 CFS USE THE ABOVE TRIALS TO ESTABLISH A TOWN-STREAM X-SEC RATING CURVE FOR NORMAL POOL: RREACH OPZ = 1378 CFS -> STAGE = 2.9' WISTAGE = 2.9' VOLUME = 5 AL-FT €. ZPERIH Ong (TRIAL) = 1328 (1- 50-9-7)=8590FS-> STAGE = 2.5' W/STAGE = 2.2' VOLUME = 3AC-FT EREACH Org = /328 (1- (3+3)2) = 949 CFS > STAGE = 2.3' HUTECEDENT Q= 407 CFS -> STAGE = 1.9' THE TIMPEASE IN STAGE CAUSED BY A PREACH AT NORMAL POOL WOULD BE = 0.9 FEET. OF MAKIMUM POOL: EREACH OF = 8987 CFS -> STAGE = 7.2' WESTER 7.2' VOLUME = ZAC-FT TREACH (194 TREAL - 8:37/1- 2000) = 8:4 :55- 1/4:5 = 7.2 2007 - Op 8937 (1-(2+2)12)= 3641 - 37452 - 72

| ANTESEDENT DESATT UNE - STRUEN TIL | . • |
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| THE STATE NEE IN STAGE CHISED BY A BATHA | |
| AT MARTHUM FOOL WOULD BE = 0.1 FEET. | |
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| NOTE: THE EFFECTS OF A BREACH AT MAY WILL | |
| POSC HAVE BEEN ATENUATED. | |
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| REACH#4 | - |
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| USE A TYPICAL CROSS SECTION ALONG THE DOWN- | . |
| STREAM REACH FROM THE DAM TO THE SECTION | |
| 5300' DOWNSTREAM AT THE SHOPPING CENTER | |
| | |
| $Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$ | |
| | |
| LENGTH OF REACH = 1000 FT (5300-4300) | |
| FLEIATION (a RESTANTING OF DEATH = 353 | . • . |
| ELEVATIONS @ ENT OF REACH = 395 | |
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| 11,703ITE N = 0.075 | , |
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| TEPL #1 STREE = 1' The MAN | |
| 0=1.4%,075.82/8-/94.5) (0.008) = 143 cFS | |
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| 7721 EZ STABEEZ () (0,000) 1 302 CFS | |
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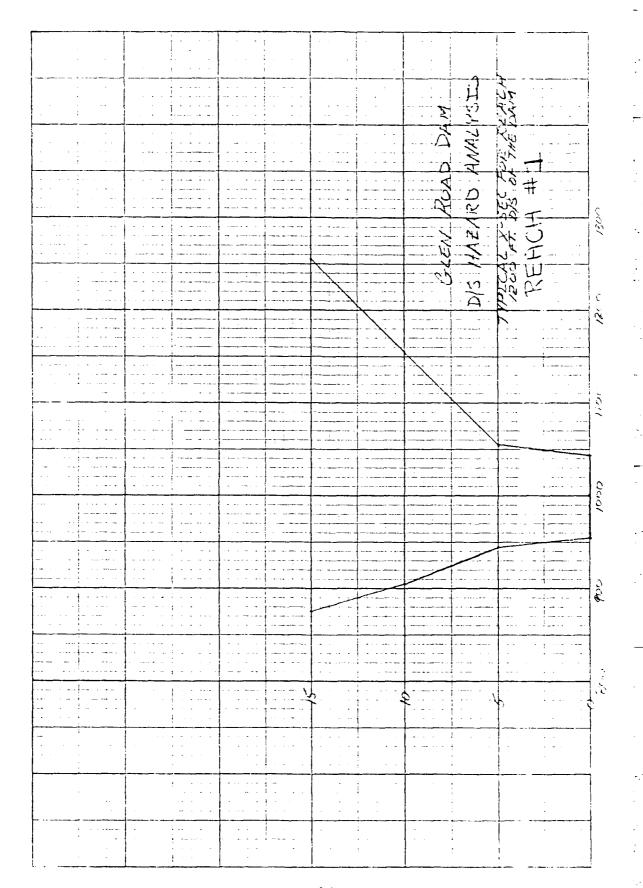
TRIAC # 3 STATE - 450 . (350/pr.5) - 10.1.) = 2.44 cm. TRICL # 9 STEE 7'
0=1.91/2=5-755-(75/152)-(0,00)=35900= () = 1.9/0.25 · 2256 · (2256/429) · (0.053) = 12/22 · 0 USE THE ABOVE TRIACS TO ESTABLISH A DOWN. STREAM X-SEC RATIONS CURVE FOR NORMAL POOL: BREACH QP = 949 CFS -> STAGE = 3.1'

W/STAGE = 3.1' VOLUME = 2 AC-FT

BREACH QP = (TRIAL) = 949 (1- 2.7) = 759 CFS -> STAGE = 2.7' WISTAGE = 2.7' VOCUME = 1.5 ACFF EREACH OFE = 949 (1 - (2+13)2) = 783 CF = -> STAGE = 2.8' ENTECEDENT Q = 40% CFS - STAGE = 1,9' . THE INCREASE IN STAGE CAUSED BY A BREACH AT NORMAL FOOL WOULD BE = 0.9 FEET

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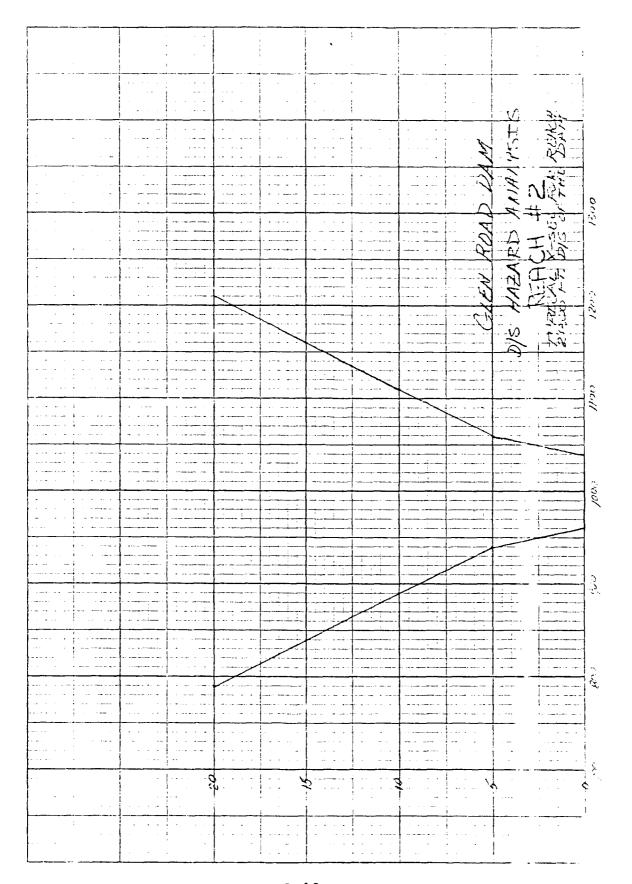
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APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

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